

What is Claimed is:

1. A magnetic recording device, comprising:
 - a) a perpendicular write head comprising a write pole having a write pole tip, and a return pole; and
 - 5 b) a recording medium comprising a longitudinal magnetic recording layer and a soft magnetic underlayer, wherein during operation of said magnetic recording device said longitudinal recording layer is disposed in relation to said perpendicular write head to place said magnetic recording layer within an effective write gap formed by said perpendicular write head and said underlayer.
- 10 2. A magnetic recording device as recited in Claim 1, wherein said perpendicular write head is a shielded pole write head comprising a write shield.
3. A magnetic recording device as recited in Claim 1, wherein said perpendicular write head is a monopole write head.
4. A magnetic recording device as recited in Claim 1, wherein said recording
15 medium further comprises a non-magnetic spacer layer disposed between said longitudinal magnetic recording layer and said soft magnetic underlayer.
5. A magnetic recording device as recited in Claim 4, wherein said non-magnetic spacer layer has a thickness of not greater than about 40 nanometers.
6. A magnetic recording device as recited in Claim 4, wherein said non-
20 magnetic spacer layer has a thickness of not greater than about 20 nanometers.
7. A magnetic recording device as recited in Claim 4, wherein said non-magnetic spacer layer has a thickness of from about 10 to 25 nanometers.
8. A magnetic recording device as recited in Claim 1, wherein said soft magnetic underlayer comprises NiFe.
- 25 9. A magnetic recording device as recited in Claim 1, wherein said soft magnetic underlayer has a magnetic coercivity of not greater than about 5 Oersteds.
10. A magnetic recording medium as recited in Claim 1, wherein said soft magnetic underlayer has a magnetic permeability of at least about 50.
11. A magnetic recording device as recited in Claim 1, wherein said soft
30 magnetic underlayer has a thickness sufficient to prevent saturation of said underlayer by said perpendicular write head.

12. A magnetic recording device as recited in Claim 1, wherein said soft magnetic underlayer has a thickness of at least about 30 nanometers.

13. A magnetic recording device as recited in Claim 1, wherein said soft magnetic underlayer has a thickness of from about 30 nanometers to about 200
5 nanometers.

14. A magnetic recording device as recited in Claim 1, wherein said longitudinal magnetic recording layer has a coercivity of at least about 4000 Oe.

15. A magnetic recording device as recited in Claim 2, wherein the distance from the top of said soft magnetic underlayer to said write pole tip is about equal to the
10 distance from said write pole tip to said write shield.

16. A magnetic recording device as recited in Claim 4, wherein the distance from the top of said soft magnetic underlayer to the center of said longitudinal magnetic recording layer is about equal to the magnetic spacing during operation of said magnetic recording device.

15 17. A magnetic recording device as recited in Claim 4, wherein the distance from the top of said soft magnetic underlayer to the center of said longitudinal magnetic recording layer is from about 13 to about 31 nanometers.

18. A magnetic recording device as recited in Claim 4, wherein the magnetic spacing is from about 10 to about 30 nanometers.

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19. A magnetic recording device, comprising:
a) a shielded pole write head having a write pole tip and a write shield;
and

b) a magnetic recording medium disposed under said shielded pole
write head, said magnetic recording medium comprising:

i) a soft magnetic underlayer having a magnetic permeability of
at least about 50;

ii) a non-magnetic spacer layer disposed over said underlayer;
and

iii) a longitudinal magnetic recording layer disposed over said
non-magnetic spacer layer.

20. A magnetic recording device as recited in Claim 19, wherein said
underlayer has a thickness of at least about 30 nanometers.

21. A magnetic recording device as recited in Claim 19, wherein said
underlayer has a thickness of from about 100 nanometers to about 200 nanometers.

22. A magnetic recording medium as recited in Claim 19 wherein said
underlayer has a magnetic permeability of at least about 100.

23. A magnetic recording medium as recited in Claim 19, wherein said
underlayer has a magnetic coercivity of not greater than about 5 Oe.

24. A magnetic recording device as recited in Claim 19, wherein said non-
magnetic spacer layer has a thickness of not greater than about 40 nanometers.

25. A magnetic recording device as recited in Claim 19, wherein said non-
magnetic spacer layer has a thickness of not greater than about 20 nanometers.

26. A magnetic recording device as recited in Claim 19, wherein said non-
magnetic spacer layer has a thickness of from about 10 nanometers to about 25
nanometers

27. A magnetic recording device as recited in Claim 19, wherein said
longitudinal magnetic recording layer has a coercivity of at least about 4000 Oe.

28. A magnetic recording device as recited in Claim 19, wherein the distance
from the top of said soft magnetic underlayer to said write pole tip is about equal to the
distance from said write pole tip to said write shield.

29. A magnetic recording device as recited in Claim 19, wherein the distance from the top of said soft magnetic underlayer to the center of said longitudinal magnetic recording layer is about equal to the magnetic spacing during operation of said magnetic recording device.

5 30. A magnetic recording device as recited in Claim 19, wherein the distance from the top of said soft magnetic underlayer to the center of said longitudinal magnetic recording layer is from about 13 to about 31 nanometers.

31. A magnetic recording device as recited in Claim 19, wherein the magnetic spacing is from about 10 to about 30 nanometers.

10 32. A magnetic recording device as recited in Claim 19, wherein said shielded pole write head comprises a write coil and a bucking coil having an equal number of turns.

33. A magnetic recording device as recited in Claim 19, wherein said shielded pole write head comprises a write coil and a bucking coil and wherein said bucking coil
15 has fewer turns than said write coil.

34. A magnetic recording device as recited in Claim 19, wherein said shielded pole write head comprises a write pole and a write coil wrapped around said write pole.

35. A magnetic recording medium, comprising:

a) a substrate;

b) an underlayer disposed over said substrate, said underlayer having a magnetic permeability of at least about 50;

5 c) a non-magnetic spacer layer disposed over said underlayer, said non-magnetic spacer layer having a thickness of not greater than about 40 nanometers; and

d) a longitudinal magnetic recording layer disposed over said non-magnetic spacer layer, said longitudinal recording layer having a coercivity of at least about 4000 Oe.

10 36. A magnetic recording medium as recited in Claim 35, wherein said substrate is a rigid substrate.

37. A magnetic recording medium as recited in Claim 35, wherein said underlayer has a magnetic permeability of at least about 100.

15 38. A magnetic recording medium as recited in Claim 35, wherein said underlayer has a magnetic coercivity of not greater than about 5 Oe.

39. A magnetic recording medium as recited in Claim 35, wherein said underlayer has a magnetic coercivity of not greater than about 2 Oe.

20 40. A magnetic recording medium as recited in Claim 35, wherein said underlayer has a thickness of at least about 30 nanometers.

41. A magnetic recording medium as recited in Claim 35, wherein said underlayer has a thickness of at least about 100 nanometers.

42. A magnetic recording medium as recited in Claim 35, wherein said underlayer has a thickness of from about 100 nanometers to about 200 nanometers.

25 43. A magnetic recording medium as recited in Claim 35, wherein said underlayer is fabricated from a material selected from the group consisting of NiFe, FeTaC and CoZrNb.

30 44. A magnetic recording medium as recited in Claim 35, wherein said non-magnetic spacer layer has a thickness of from about 10 nanometers to about 25 nanometers.

45. A method for writing data to a longitudinal recording layer, comprising the steps of:

a) providing a perpendicular write head comprising a write pole and a return pole;

5 b) disposing a longitudinal recording layer under said write head, said recording layer having a soft magnetic underlayer disposed under said recording layer;

c) moving said longitudinal recording layer relative to said write head; and

10 d) generating a magnetic flux between said write pole and said soft magnetic underlayer, wherein said magnetic flux is applied substantially perpendicular to said longitudinal recording layer and said magnetic flux is directed to said return pole by said soft magnetic underlayer.